Governor's Upper Yellowstone River Task Force
Meeting Summary
February 25, 2003
Yellowstone Inn
Meeting began at 7:00 p.m.

I. Introductions

Members Present:
John Bailey, Chair
Dave Haug, Vice Chair
Roy Aserlind
Andy Dana
Michelle Goodwine
Jerry O'Hair
Brant Oswald
Rod Siring
Bob Wiltshire
Jim Woodhull

Ken Britton, USFS Ex-Officio
Mike Gilbert, proxy, Corps Ex-Officio
Frank Preite, USFS Ex-Officio
Robert Ray, DEQ Ex-Officio
Stan Sternberg, MDT Ex-Officio
Laurence Siroky, DNRC Ex-Officio
Joel Tohtz, FWP Ex-Officio

Others Present:
Liz Galli-Noble, Coordinator
Kelly Wade, Secretary
Duncan Patten, TAC Chair
Zack Bowen
Lurah Klaas
Danielle Gryskiewicz
George Jordan
Burt Williams
Molly Semenik
Daryl Smith
Brad Shepard
Karl Biastoch
Dale Siegle
Ken Bovee
Jim Robinson
Altan Soykan
Travis Lohrene
John Remus
Peter Husby
Jean Ramer
Jim Olsen
Chuck Parrett
Bill Moser
Jim Barrett
Michelle LeBeau
Kevin ?
Bruce Graham
Bruce Rich
Lionel Dicharry
Deon Lackey
Eric Morrison
Scott Bosse
Al Zale

II. Prior Meeting Minutes

John Bailey: Next we will review the previous minutes from February 11th, 2003.

Jerry O'Hair moved to approve the February 11, 2003 minutes as written. Roy Aserlind seconded the motion. The motion passed unanimously.

III. Financial Updates

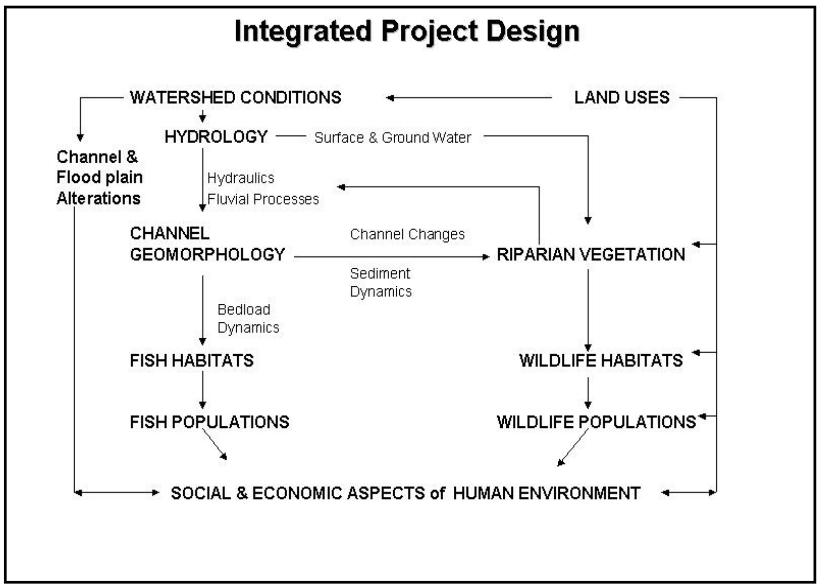
EXPENDED GRANTS			
Grant Name	**Completed**	**Amount**	**Study Component**
DNRC Watershed Planning Assistance Grant	6/30/99	2,100.00	Physical Features Inventory
DNRC HB223 Grant	7/30/99	10,000.00	Aerial photography
DNRC Riparian/Wetlands Educational Grant	6/30/00	960.99	*Hydrologic Response to the 1988 Fires* Workshop
DEQ 319 Grant (1st)	9/30/00	40,000.00	Coordinator position
DNRC Watershed Planning Assistance Grant	1/31/01	10,000.00	Watershed Land Use Study
DEQ Start-Up Grant	6/26/01	49,138.00	Coordinator position, Admin secretary, additional cross-sections, operating expenses.
DNRC HB223	10/1/01	6,500.00	Riparian Trend Analysis
BLM Funding	10/26/01	10,000.00	Wildlife Study
DEQ 319 Grant (2nd)	3/21/02	58,000.00	Coordinator position
DEQ 319 Grant (3rd)	9/30/02	44,000.00	Coordinator position
EPA RGI Grant	12/20/02	30,000.00	Geomorphology study

CURRENT GRANTS			
Grant Name	**Amount**	**Spent**	**Remaining Balance**
DNRC RDGP Grant (expires 7/03)	299,940.00	288,621.63	11,318.37
DEQ 319 Grant (4th) (expires 3/04)	122,200.00	35,235.60	86,964.40

IV. Research Presentation #8. Fish Habitat Study – Effects of Channel Modification on Fish Habitat in the Upper Yellowstone River

1. Meeting Format and Introductions

John Bailey: Before we go into the presentation, for those of you that haven't been here before, I would like to go over the rules that the Task Force set for these research presentations. There will be no questions allowed during the presentation. At the end of the presentation, the Task Force first will be allowed to ask questions. After some time, depending on how many questions are posed, we will then allow the public to ask questions. So, it's a two-step process: the Task Force first, then the public. We then move to the next part of the meeting, which is a general discussion session. During the questions session, you may only ask questions that relate to the research. If you ask for speculation from the researchers, you'll be cut off. The researchers are here to present their research findings, not to speculate. If you start asking questions outside that research, they will not be accepted. During the general discussion session, again the Task Force will be able to speak first, and then we'll open it up again to the public. During the general discussion, you can bring in things from elsewhere, how it relates to other things. Sometimes the researchers stay for that, sometimes they don't. They are not required to, but it's sometimes very interesting. Right now I'd like to introduce Dr. Duncan Patten, the chair of our Technical Advisory Committee, and he's going to introduce the researchers.



Duncan Patten: I'm going to get my diagram here. This is still useful in the sense that we have worked our way down through here, and we're about to come out the bottom of this diagram now. We've had the fish population study presented by Al Zale and his crew, we've had the wildlife study, we've had the riparian vegetation study, and we're now, tonight, basically looking at the fish habitat study, which in some way lead into the fish population study, but they're truly interlinked. The arrows on the diagram can go either way, it doesn't really matter, because they are closely interlinked. So this just gives you some idea, and really this is sort of the end of the line, in terms of all the research that we've had. You can see all the pieces that fall in place with this diagram. Somebody could draw it another way, but this happened about two years ago, and here it sits. Tonight, Zack Bowen and his research team (Ken Bovee and Terry Waddle) are going to give the presentation on fish habitat and channel modification, the work that they've done over the last couple of years. You'll see how this ties in closely to some of the other studies that we've had. In some ways, you can even relate it to some of the riparian, geomorphology, and fish population studies, and other things that have gone on. So, Zack, the floor is yours.

2. Research Presentation #8. Fish Habitat Study – Effects of Channel Modification on Fish Habitat in the Upper Yellowstone River. See attachment *Fish Habitat and Channel Modification in the Upper Yellowstone River* PowerPoint presentation.

Note: This presentation was videotaped and may be viewed upon request. Contact the Task Force Coordinator if you wish to borrow the videotape.

3. Question and Answer Session

John Bailey: Any questions from the Task Force?

Dave Haug: One thing you mentioned early on was that when you went through a lot of your conditions, you said you had some in there that were approximated. What were the unmeasured conditions you approximated?

Zack Bowen: What we did was, we went out at one flow, which was 2002 during runoff. And we did that because that's when the water's highest and we can get our boat into lots of places and it's deep enough for everything to work (for all the instruments to work). So that's when we measured stuff. We measured the depths and did all the topography in the main channel at that flow. We also ran around with a GPS on a stick and all that other stuff. So that's when we got the topography. You bring up a real good point, and I think it's in the report. What we did is like a snapshot of what the topography was like right then. It's never the same. It's changing while you're measuring it. So we had that one set of conditions, and then we take that, and we measured a water surface profile, and we calibrated the model to that one flow. And then we simulated, that is, routed other volumes of water through that same topography, to see what the depths and velocities look like. Does that answer your question?

Dave Haug: Do you have any other conditions that weren't measured, that you added in for factors? Any other conditions, you mentioned these unmeasured conditions.

Zack Bowen: That's what I was talking about. I might not have made that clear enough, but that's what I meant. There's the calibration part, where you're basically getting the model to match what you measured. Then that's the reason we use the model is to look at other flows that we didn't go out and measure. Like looking at a drought, we're looking at a bigger flood, things like that.

Ken Bovee: I can maybe address some of that too. There's one other part that we looked at and that's the large woody debris. And the way that the algorithm for that particular coverage—that map—is set up is based on a couple of conceptions. One of which is that right at the surface of a large object, the velocity is zero, and as you move away from that object, the farther you get away from it, the less influence it has on the velocity itself. So that was a basic premise that we used to build that large woody debris force field, if you want to call it that. I feel pretty good about saying right at the face of a stem, the water isn't moving. And some distance away, it is moving, and it's not having any effect. The big question mark is—that we didn't measure and I don't think anybody has—how far is it (the influence of that wood)? Well, for big stems we said it was ten feet, and for little stems we said it was five feet. I think that's probably pretty conservative, but at least it's consistent. That's another one of those things that we didn't measure, but that is what we think is a fairly reasonable way of estimating the influence of that wood on velocities.

Roy Aserlind: Several times in your report you mentioned downstream displacement during periods of high runoff. Now is this downstream displacement something we should view in a negative sense? Is there a higher juvenile trout mortality associated with downstream displacement or not?

Ken Bovee: I've looked at a lot of streams in Colorado, most of which are confined streams, and although we don't know exactly what the cause of mortality is, I think I do have a good idea. You've got fish that are this long, and they can't swim for beans, and in addition, they have to eat zooplankton, very little small food items. In high velocity water you don't find those zooplankton that these little fish have to eat. So I think in a lot of cases when they're displaced downstream, one of two things happens to them: (1) either they're displaced far enough downstream to where the water is too warm for them (they end up in Sydney), or (2) they starve to death. When they're out there in that fast water, they don't drown, they don't get crushed, they just get moved and they are separated from food sources long enough that they die. And what we found in confined streams in Colorado is that the amount of that slow, shallow current velocity habitat is tied very strongly to year class strength. The recruitment of, especially in trout, from one year to another, we're talking about year class strength, and what happens in a lot of these streams in Colorado is that the only habitat that's available for little fish is out in the main channel. So the only times that you get big year classes is when you don't have any runoff, when you have droughts. If you have a drought and you're in Colorado, you're going to have little baby fish all over the place. If you have a year like 1997, in Colorado, you probably won't find a one. But that's Colorado. But I would be willing to bet that something very similar to that would be happening in Montana.

Roy Aserlind: You mentioned several times in your presentation, simulations. Is there an opportunity, or a necessity you felt for doing downstream validation of your simulations? Did you feel that was necessary? In other words, you do a downstream simulation, and then would you try to validate that through empirical evidence, during the course of your study?

Zack Bowen: I'm going to answer that in sort of simple terms now and hand it to Dr. Waddle, who can answer it in more expert terms. Basically, what we're trying to do is match a set of conditions that existed while we were there, and then, in terms of the simulation, what you're saying would be ideal. If we were to come back up at different flows and check. We didn't do that.

Terry Waddle: Well, actually we did.

Zack Bowen: We did it in a sense, but we didn't come back and make repeated trips at a whole bunch of different flows.

Terry Waddle: In the best of all worlds, you repeat the entire set of measurements for every flow that was of critical interest, and only interpolate to areas of less interest. But then the cost of the study, and the time it would take, would be just out of range. So, what we do is get an additional set of water surface elevation information at a lower flow, use the conditions of the first set of measurements to predict that second set of measurements, without including any of the second set of measurements in the information used to make the prediction. And then compare them. If the first measurements and adjustments predict the second conditions very well, then we say, "That's a homerun". On this river, some places it was very successful, other places it was marginally successful, and I can frankly attribute that to this being such a fantastically high-energy river. As I told my colleagues, when we were up here the first time, we were out on the river and we're bouncing around a little bit like taking water in the boat and a few other things, and I thought you know, I didn't have enough life insurance for this trip. We have validated our measurements, not downstream but to a different discharge.

Roy Aserlind: Okay. One more, and this is just kind of personal curiosity. You talked about the "pings" and each ping would give you a dot. Now, how would you translate that ping to a map?

Terry Waddle: Using the GPS unit. You saw that yellow thing on the boat and the one on the bench, that allows us to know exactly where that sonar unit is, when the ping happens.

Roy Aserlind: Did you have to write down a mark on a map?

Terry Waddle: No, it's all recorded in the computers, and when we process the data, we come up then with the exact location of that sonar ping. You can see there were tens of thousands of them. It's just like if you look at a cartoon in a newspaper real closely, you see it's really little dots instead of uniform color, that's the same idea. We've got lots of dots, lots of pings.

Joel Tohtz: That was a nice presentation. Thank you very much. I have three questions for you. How big was your boat motor, I'm just curious?

Zack Bowen: It's a 350 Chevy, it's a V-8.

Joel Tohtz: I envy you. To follow up about pings, how shallow can you ping?

Zack Bowen: The instrument says it will work down to something like 30 centimeters depth, and that's pretty close. But, the other limit is where you can reliably get the boat without getting stuck. So generally we do okay if it's say, a foot and a half to two feet deep, we can get depth pretty reliably. But if it starts getting much shallower than two feet, probably it's less reliable.

Joel Tohtz: And the last question concerns the section you had on the screen there. You mentioned that approximately 20 percent of the bank, of the section or the area that you were looking at, was modified. I'm wondering if that includes the valley wall and other natural features like that?

Zack Bowen: No.

Joel Tohtz: So, it's just strictly stuff that people built?

Zack Bowen: Yes, and remember that it's not a real good thing to quote us on, to say that 20 percent is modified. Because remember, it was to the middle of the channel, that's the way we quantified it, because we had to be consistent.

Joel Tohtz: Well, actually that channel section would be controlled to a much greater extent than what you were indicating by just what was modified by people, and what wasn't; compared to that section in town. Getting to that point for this, is that mostly what you see in that section is blue [fast moving/deeper water], and that's the only section where we sampled during the high runoffs in 1996 and 1997; where we saw measurable decreases in trout abundance. Everywhere else the fish held their own pretty well, but it's only through this one reach that decreases occurred.

Zack Bowen: Great. Well, probably not great, but it's nice when things fit together. Honest to goodness, this was pretty intense through here; it would take a very lucky fish to make it in that reach during runoff. It's really intense.

Ken Bovee: It's just that it's not going to go upstream.

Terry Waddle: I'm not a fish person at all, but you know Ken's story about the little fish can't survive in the strong current? Okay, take your 1997 flood, put it through that channel and now you've got a much bigger sized fish that gets pushed downstream instead of just that small one. It makes sense.

Bob Wiltshire: You showed us the graph of the slow shallow habitat versus the degree of modification. I'm wondering was there a statistical significance in that difference?

Zack Bowen: We didn't calculate any statistics on that, mainly because we were just looking at three sites, and we're trying to give the big picture. Now, what we could do, Al had more statistics in his report. Part of the reason was he broke the Livingston reach up into chunks, and because he couldn't sample that whole bank all the way through, he picked and sampled, and he used statistics to talk about differences. But what we did was a little different. We mapped the whole thing, and then just showed the differences in the maps. So there's no statistical anything with that, that's just dots on a graph. But if we had say six, 10, 15 more sites, and we had years and years and years to do this, we could maybe build enough points into that graph where we could really do some statistics on it.

Bob Wiltshire: Would you bring that back next week?

Brant Oswald: I have two questions, and they are really related. Related in the sense of the Task Force being able to compare the studies that we're seeing on the Yellowstone to other areas. Your "slow shallow habitat" definition, the way that that was broken down, I think you mentioned that you used the same definition that Dr. Zale used, so we could compare between those two. Is that a standardized definition that's used, in terms of recognizing what fry and juveniles use and that sort of thing? Are those velocities and depths something that's used by other researchers, or is that something that was devised for the Yellowstone?

Zack Bowen: To use sort of a "wiggle word", I'd say that in general those values and values like those are widely accepted for little fish. Now, you could go out and do this same kind of sampling that Al did in a different river, and you might find fish out to slightly different depths. You might find more of them in slightly faster water, or slightly slower water, something like that. But in general, I think between what Al found, what Jim and others have found in Colorado, and really lots of other studies in different kinds of systems—when looking at even warm water fisheries—little fish need shallow and slow water. That's pretty well documented.

You could probably argue some about the exact boundary of what's shallow and what is slow, and what is little.

Brant Oswald: Even though we didn't really talk about it explicitly, it might have been an important part of the study, was the talk about roughness coefficients and roughness parameters. Are those fairly standardized? Can we start to look at other river systems to get some perspective on what's going on here?

Ken Bovee: I think in terms of the models we're using, let me kind of rephrase the answer here before I give it to you. There are two different ways of looking at roughness. In some of the hydraulic models that are commonly used, they're called the step backwater type model, and they are the kinds of models where roughness is a calibration parameter. What you do basically is you dial it up and you dial it down, and you do that until the water surface that you are predicting in the model matches what you measured in the field. And you can get carried away with this; it's what Zack was talking about earlier. It's possible to match that water surface profile exactly, and you can know right on the money. But what you'll have is roughness coefficients that go from sand at one place to Volkswagen-sized boulders right next to it, even though all the rocks are as big as my fist. So you have to be very careful in doing that calibration, and not fall into that trap of trying to match things too exactly. In the case of the two-dimensional models, it's not a roughness coefficient, but rather a roughness height. The roughness height is actually more tied in to the actual size of the particles that are on the streambed. They're still used pretty much the same way, if I understand you correctly; if I understand him correctly.

Terry Waddle: Yes, now from your answer I got the word that I missed in the question. The roughness representation used in the particular model we used is a height; however, it is a scaled height, so it still is adjusted somewhat to match the conditions. However, as Ken just said, you don't use a sand number in the Yellowstone River like this. Downstream we've used sand numbers, down near the Montana North Dakota border. Life is different there. The method of representing this resistance to flow—resistance to water movement—is different among different models. The roughness representation actually has to be a different kind. There is a two-dimensional model developed by the Corps of Engineers, actually since the 1960s, and they use something called an "eddy viscosity". It's a totally different representation, and in fact, it does not have a physical meaning; it's more of just a tuning factor. So I think the answer to your question is it's dependent upon the model, and frankly this is where I would say the art of modeling becomes some of the criteria of what you can represent. A skilled person can play with that a little better, and get a result that is a little more reliable. Maybe I should have just said, "no".

John Bailey: I want to go back to what I thought was a bit of speculation. Since you were looking for slow water, and where you found the most area was when we had high flows. But you said that in Colorado there was no recruitment on these small fish in higher water, because they were all blown downriver, and you suspected the same thing happened here. But on your low flow maps, you don't show any pink and on the high flows you do show pink. I want to make sure I understood what you said because I'm assuming these maps say we do better in high water.

Ken Bovee: Yes and no. There are two things we want to make real clear. One of which is that all the streams I mentioned in Colorado are confined rivers. They don't have flood plains and they don't have side channels. Virtually every one of them looks like that stretch from Ninth Street Bridge down to Mayor's Landing. That's what these Colorado rivers, that I referred to, all look like. In those kinds of rivers, the only time you ever get that slow shallow habitat created is when you have low runoff. And by low runoff, I'm not talking about base flows or drought flows, what I'm talking about in the Yellowstone would be a flow during June of maybe 10,000 cfs (cubic feet per second). So we're not talking about 500 cfs in the Yellowstone during runoff, and that's the critical time period. Does that help?

John Bailey: These maps are done at 24,000 cfs. You're the one that has sort of brought in that we do better at low flows and so now I'm not sure how to interpret the maps. Are we going to have good recruitment at 24,000 cfs when you show the most pink?

Ken Bovee: That would require a bit of speculation on my part, but I'm going to say that generally speaking, the more of that pink you have, the better off you're going to be in terms of recruitment. Yes, that does happen at high flows. It happens at high flows in the Yellowstone because it has a chance to spread out. Just remember what Zack was saying, that's where that stuff shows up, it's not in the main channel, it's all showing up out in the side channels. I'm going to go way out on a limb here because we've simulated but not mapped it, but I'm going to bet that at 10,000 cfs, which is about the peak flow that you had during the drought year, I bet you've got pink stuff all over the place. I bet those side channels are just primo.

Zack Bowen: I think the main point that we were trying to make with these maps is that during runoff, which is an important time for the little fish, not completely but for the most part, it's pretty deep and it's pretty fast. The places where you find the shallow, slow areas, where these little fish can hang out and stay in this general area during runoff, those places exist in these side channels and in flooded overbank areas. That's where they exist, and what Ken's talking about is related to this, but just for right now let's just think about this as high flow, most of the shallow stuff is in overbank and side channels and backwaters. And that's on the Yellowstone River; it's a big old alluvial floodplain river. What Ken's talking about is in Colorado, where a lot of the rivers look like that reach between the golf course and just a little bit upstream. The river looks like that naturally because it is very steep and confined in a mountain valley. In that situation, if the water goes fast, it's just like that reach right next to the golf course, there's nowhere for the fish to go. But if the water is going slow, for instance when you're in a drought year, there are more places for fish to hang on locally. In Colorado streams, low runoff tends to be associated with high recruitment. And what we're saying here is that during the crunch time for little fish in this river, the place for them to be and to survive and stay in this area, it's the shallow areas in the side channels and flood plains.

Duncan Patten: Let me just expand on that. I'll give another example and that's in the Grand Canyon. You have 120,000 cfs coming down the river, that's snowmelt coming out of the mountains. All the little fish just head up the tributaries and hang out because those don't have the snowmelt, they're not running high at the same time the main stem is high. Basically those little tributaries are functioning the same as your secondary channels here, your slow water on the point bars, high on the point bars, overbank and the rest. It's just the refugia for little fish. When you get down to 1,500 cfs, the mainstem here is flowing as low flow practically, so much of the main stem can function as a refugia for your streams. Where you had drought, and therefore no runoff, now you can get recruitment because there is no place else for them to go, but they don't have to go anywhere.

Zack Bowen: That's right and if you look at this like it was at 24,000 cfs, and then if we go down to 5,000 cfs, which is a recession flow, that's a pretty darn big difference. You've now lost most of the pink areas that were in the overbank, and now it's in backwaters, and it's getting down towards the margin of the main channel. If you remember when Al was out there sampling, he was probably sampling around 5,000 cfs and less, so you can see why the little fish were where they were; if you look along the margins, well that's where the habitat is, especially around base flow. The shallow water habitat is associated with the margins. So if that's where the shallow water habitat is (associated with the margins), and then you throw in this great juvenile fish condominium with all the boulders and little places for them to hide and get away from predators, plus it's adjacent to current where they can drift feed and they can get invertebrates out of the riprap, it's a pretty good deal for them. But the point is that it's a good deal for them at base flow, but when the water comes up, they can't be here because it's going to be going too fast.

Roy Aserlind: I'll give you an easy one here. How is that 5,000 cfs recession flow determined? Is that an arbitrary determination, or is there some reason for it?

Ken Bovee: It's kind of arbitrary. It's sort of halfway between the peak flow and the base flow. We know what the base flow typically is, we know what the bankfull flow is, and so this would be not halfway between the two, but it's more like what the flow would be in the middle of July. It was a little bit arbitrary and we could have picked a lot of different flows; it was just to give a representation of what happens in between the big flow and the little flow.

Andy Dana: This may be a speculative question, in which case let it pass, but there seems to be an underlying assumption that the critical time for the juvenile fish is the runoff period. That's two months out of the year, while for ten months out of the year we have a channel where small fish are exposed to predators, to a whole host of other different stresses, and I wonder whether you have, or anyone has, looked at relative importance of a stressed system like this for juvenile fish? Where there is so little habitat compared to the stresses that are put on them by the floods. Looking at fish habitat, could this be more critical than the slow water, shallow habitat in flood stage?

Zack Bowen: That's a good question. In response, I don't know, and I'm not sure if Ken or Terry knows, if the different species of salmonids you have in the Yellowstone River are indeed recruitment limited. Is that a limiting factor? Do you know, Joel?

Joel Tohtz: We have never had any indication of restriction. There's one point here that I hope is being made. You're talking about mainstem recruitment. We have a lot of fish that come in from outside the mainstem, and that's the key here. That's why we don't see recruiting limitations. If we were all of a sudden held to the main thread of the river, and had to see how trout performed, it would probably be a different story than what we have.

Zack Bowen: That's part of the message we're trying to convey as well. We don't know at what point, for instance let's pretend that this is at 1,500 cfs, let's pretend that this whole thing has been… Actually, are we supposed to be doing that yet? Probably not, okay. Not pretending.

Andy Dana: I'm not sure that I understand.

Zack Bowen: We may not have answered your question. Could you maybe repeat it in short, so I can try again?

Andy Dana: Well, I'm wondering about the relative importance of the juvenile habitat to recruitment at low flows, compared to what seems to be the major focus of your study: looking at high water.

Zack Bowen: Actually, we're not saying that low flows, that habitat availability at low flows is unimportant. We're not saying that. What we are saying is that, typically, for the little fish, the time when they have to be concerned about retaining their position in the river, is during runoff. That's not saying that it's unimportant at low flows, and we're indeed showing that, at low flows you do have that shallow water habitat along the margins.

Andy Dana: Has that always been an assumption though, or is that documented, that the more important time is the high flow? I think I just heard you say that, for the little fish, it's much more important to have the habitat for recruitment purposes.

Ken Bovee: There have not been a whole lot of studies along those lines. There have been three relatively major studies, or I consider them to be major studies, looking at this phenomenon. One was conducted by a couple of biologists in Colorado named Neering and Anderson. They looked at eight different rivers in Colorado and the habitat events (if we can call them that) that occurred during the year, and which of those that translated into year class strength correlations, and how many of those year class strength correlations actually carried over and translated in to the adult populations. In other words, you have a big year class in one year, four years later did you have a big bunch of adults from that same year class? What they found was that, yes indeed, it was during the spring runoff for probably about two weeks, was the make-or-break time. Now, I did a study in Michigan, in the early 1990s, looking at Small Mouth Bass. Same thing, same exact thing. We looked at wintertime, we looked at summertime, all through the year, and the only time that had any kind of a relationship between the habitat event itself and year class strength was during runoff. Zack did some work down in Alabama, it wasn't exactly a runoff situation like we have here, but it's more of a hydropeaking process. But once again, it was periods of high flow that were the ones that were really important. Those are the three that I'm aware of, do you know of any more Zack?

Zack Bowen: There have been quite a few studies that, like Ken's talked about, document this. Really, it's something we can talk about at length, but I don't know if we've answered your question or not.

Jerry O'Hair: I'm not a fisherman, but your study seems to emphasize the small-sized, juvenile type fish. I'm wondering if you have a large juvenile population, does that give an indication of a good or large adult population, or an environment that is conducive for adult fish also?

Zack Bowen: The way that I think about it, it may not be the best way, is that it is a necessary condition to have lots of adults to have lots of juveniles. There is a connection there. If you don't have the little fish, you're not going to get the age classes that take you up to the big fish. But, for any life stage, there are things that are going to cause the fish to die; there are things that effect the population. It varies by life stage. The reason we concentrated on the juveniles is they're, not always but typically, pretty vulnerable. Another source of mortality for the bigger fish is being caught and eaten, not only by people, but by predators. And the same thing goes for the little fish; they can get caught by predators, but they're typically not going to have fishing pressure taking them out of the picture. But generally speaking, the little ones are most vulnerable, and that's why we concentrated on them, plus you have to have them to get the big ones. Did that answer your question?

Ken Bovee: I think he was really asking if this river is recruitment limited, if I read the question correctly. Your question was "does a strong year class of juveniles translate into a large population of adults somewhere down the road?" The answer is, not always. A lot of times it does, but not always. On the Yellowstone, I have no idea.

Jerry O'Hair: So your study really just went to the juvenile end mostly, and not to the adult phase?

Ken Bovee: That's right. For a couple of very good reasons, I think. As Zack said, the juveniles tend to be the most vulnerable. Many populations of sport fish are indeed recruitment limited. The fact is, if you don't have those big year classes of juveniles periodically, the adult population eventually just kind of goes downhill. You don't have to have a big year class every year, just enough, often enough, that you kind of keep that adult population rolling along. One of the cool things that I think happens, oh I'm speculating… When I get to the public comments I'll talk about some speculation later on.

John Bailey: I'd like to open it up to the public for questions at this time.

Bill Moser: If you overlay the number of fish per mile that we see in the paper every so often, it seems like your orange and red, pink and red data is backwards as to where the large volumes of fish is found. I don't know if that's accurate or not, but it seems like it from what you showed tonight. That the Livingston/Ninth Street Island Bridge area is supposedly the largest volume of fish per linear whatever of the river.

Zack Bowen: That very well may be. We didn't use those data in this study, and that could be the case. I don't know. But the thing you ought to keep in mind that might affect that is the size of the fish that were being sampled to generate those pictures or maps, as well as when they were being sampled, because the fish are different places at different times of year. That might feed into why the maps look radically different, as far as where the fish are, versus where we are showing stuff. If they're talking about adults at base flow versus what we're concentrating on here, which is juveniles, it's not quite apples and peaches, but it's pretty close.

Bruce Rich: There was a graph that's in the handout, it's normalized habitat area in acres per mile on the left (on the y-axis) and then the triple bars for AA, Tecca, and Livingston in the treatment types. Then in your presentation on the right (the y-axis), you had fish density, or fish abundance. What I'm trying to get at is specifically, what are those units of the fish abundance over there, for starters?

Zack Bowen: What we did for the report was at base flow. We wrote the report and then thought we're going to be nifty and put the fish right on there so people could see that as well. So that's why our presentation graph looks different than the report graph. We added the fish to make the point that they were typically in different places.

Bruce Rich: So, specifically, what were those units of fish abundance?

Zack Bowen: It was number per sampling unit, which was 50 meters of bank length. We really just borrowed Al Zale's data, and put them in our picture so that we could make the point that the place where the fish were using, these modified habitats, there wasn't as much of this shallow water habitat there.

Bruce Rich: Okay, that helps a little. I guess what I was trying to get at from looking at this thing is, and it gets us back to Doug and Al's presentation, that while we can certainly see some high densities of juveniles at certain flows in these treatment reaches (with the treatment banks being kind of linear and one-dimensional), I consider them sort of one-dimensional in shape as opposed to those overbank and side channel habitats being sort of two-dimensional and having more area. And that perhaps by multiplying these out, we might find that we have lots more juveniles overall using these other habitats, than we do in the treatments; even though the densities within the treatment areas are higher.

Ken Bovee: It's that "normalizing", how do you normalize it?

Zack Bowen: In this case, we just showed the amount of habitat in these different bank types for the whole site. We did that to try to keep things simple. You can start prorating things among habitat types, but then you're normalizing twice and we thought that was a little hokey. We just decided to stick with the whole area for the whole site, broken into the different classes, and then we divided that by how many miles of valley length there were.

Duncan Patten: Zack, the fish data doesn't relate to your area. That's a whole different set of measurements and he's trying to put the fish data with your area and you can't do that.

Zack Bowen: No, I don't think so. I don't think you'd be very safe to try to project how many fish you're going to have in a certain place based on our data. The main point we were trying to make here is simply that Al caught as many or more fish in these modified areas, but there was typically less of that shallow water habitat available in those modified areas, which leads us to believe that, and this is a bad word, but they kind of "prefer" those modified areas because of the boulders. That's what we're thinking.

Bruce Rich: The fact that maybe you can't make that projection is perhaps maybe what I'm trying to bring to light, in that in case anybody might want to go there, it might be good to point out that, just because the fish abundances, as per the right y-axis, seem high in the riprap, jettied, barbed reaches, doesn't necessarily translate to that's where most of the juveniles on the landscape are located.

Zack Bowen: You're exactly right, and I was being very facetious when I was teasing Al, because that was one of the main points he was making in his presentation if you remember, he said "I don't want to see in the paper tomorrow that riprap is good for fish". He said that about three times and he had it in a slide, so I was being facetious and I didn't mean to throw anybody off, because that is not the point. The point is sort of the opposite.

Al Zale: Ken, when can you start digitizing the boulders?

Ken Bovee: The boulders of the barbs?

Al Zale: Well you did the large, woody debris, but it turns out the boulders are important. Maybe you can do them as well?

Ken Bovee: Actually, do you want to show them? Do you want to see this? It's cool. [See PowerPoint Slides #63 to 68.] This is the cutting room floor now. I'll let Terry explain this as we go along, but what we did is we took a very detailed look at the barb field at Double AA, and so Terry simulated the whole thing. We did the whole analysis, the hydraulics, etc. Did we ever get to do the habitat? I don't know if we've made it.

Terry Waddle: Yes, we have.

Ken Bovee: Anyway, what he did is he went through and simulated a very high density, remember that mesh that Zack was talking about earlier? He used a mesh density in that boulder field at Double AA, ten times higher than it was in the rest of the study area. So he just really got into every nook and cranny of the rocks in there, and went through with the old electronic bulldozer and took them all out.

Terry Waddle: Be careful. I'll just show you quickly three pictures I think will give the correct impression. But the one thing I need to remind everybody or mention to everybody is, you saw that mesh idea. To actually represent the voids between individual rocks would require like 80 or 100 million nodes and our rough upper limit is like 60,000, so we're not representing the spaces between individual rocks. It's theoretically possible, but it's not practical with the current technology. Give me a super computer and a big budget, and I'd really love to do it, but that's a different story. Here's what we did do to simulate this. So, we took this little piece of the Double AA site, and I zoomed in. So, I'm zooming in again, and represented this whole area. There's a technique in the model that you can cut out a piece like this, and I can tell you about that if you're interested later, but there are just two barbs showing here and you can see the big scour at the point of it, so this is depth again, where the hottest color is deepest. So that's what kind of thing goes on there. Here is the velocity field that sets up around it with the barbs, and if we remove the barbs it's a totally different velocity field. In a nutshell, you can see that the depth and the velocity are up against the bank. Well, nobody is surprised at that, that's why you put barbs there in the first place.

Duncan Patten: Go back to the other ones.

Terry Waddle: Actually, I'm going to get out of this mode so I can go up and down faster. You mean this one?

Duncan Patten: Yes, I was trying to compare the two. The other one is a straight shot with all the blues and greens, covering all the reds and yellows.

Terry Waddle: Yes, see this is depth again, and the arrows are the velocity so the depth is out past the barbs where you expect, that's why you put them in there, to keep it from scouring the bank, so it's scouring out here instead. And this is the velocity field that's set up, including an eddy that forms behind the barb at this discharge. So you end up with lower velocities in the shadow. And then if you look at, once they're removed, you have higher velocities closer to the bank. If you remember the zoom, we're not representing the other side of the channel, it's clear over here where you see the arrow now. This is just a cut out piece along the bank to be able to use the model to zoom in.

Scott Bosse: If the crunch time for juvenile fish really is during high flows, and I believe that it probably is, does that mean that making bank stabilization structures more "fish friendly" probably will not translate into additional juvenile fish recruitment? Do you understand the question?

Zack Bowen: I'm just thinking about "fish friendly" right now.

Scott Bosse: Well, what I mean by that, I know a lot of consulting companies are doing this, they're adding either willow plantings within riprap or anchoring root wads to riprap to make it more fish friendly, and it strikes me that, during high flow periods, that's really not going to make any difference, is that correct?

Zack Bowen: Fish friendly sounds very suspiciously anthropogenic to me. It sounds "aesthetically pleasing", to me. I don't know if that's true or not, and I haven't seen any studies that try to document the extent of juvenile use of fish friendly versus a big pile of boulders. I don't know how the fish might view that and use those two. But my guess is that, if you're looking at an individual bank stabilization structure, whether or not it has little willows on it is probably not going to matter. And in reality, if you look at the barbs on Double AA, what they did is they put all the boulders in, and then they put dirt on top of them, then they seeded it, and they went to all this trouble, and then what happened when the flow came up, well it peeled all the dirt off, so you've got big bare barbs now.

Scott Bosse: The reason I ask that question is because after Al Zale's presentation a couple weeks ago, some of the Task Force members asked "does this have implications for making bank stabilization structures more fish friendly?" In other words, since juvenile fish tended to be associated with jetties and riprap more than unmodified areas, is there something about the structures that makes them more hospitable to juvenile fish? And what I'm trying to get at, is that it seems that this study doesn't contradict Al's study. In other words, Al's study is factual, but in fact, shallow, slow water habitat is probably more important during high flows than low flows, therefore there is nothing you can really do to bank stabilization structures to make them fish friendly.

Zack Bowen: This is all in the speculation department, but I think you're probably right. In terms of the relative value of different stabilization techniques to juvenile fish, when they would use it, at base flow, that would make a nifty study, but I don't know that it's been done yet. But here's the extreme example. If you, instead of making your barb out of boulders, just had tons of money and you decided you were going to pour a concrete barb, just pour the whole thing and make a damn fort, I would say that is very un-fish-friendly, because you're losing the voids and you're losing the places for the little fish to hide. And I think that's what matters, but that's all speculation pretty much.

Jim Barrett: You guys might not be the right people to answer this, but I'll ask anyway. Can juvenile fish, however they disperse from the redds or wherever they come from, and they're flung out into the wild blue yonder there, do they just accidentally snag the first habitat they come to, or what causes them to congregate especially in, if they do congregate around the rocks and so on, how does that happen?

Zack Bowen: There have actually been companies that made neutrally buoyant beads to look at just what you're talking about because it is real important. And it matters not just in the Yellowstone, it matters anywhere you've got little, bitty fish that can't swim. They're planktonic you know. When they emerge from the gravels or wherever they are, they can't swim, they're just floating along, and what's of great interest is where they wind up. A very large proportion of them probably wind up getting eaten, or just going downstream, like Ken said, until they expire. But some fraction of those that emerge are going to get entrained into a backwater, a side channel, they're going to get pushed out onto a flood plain, and what we're talking about here, are the very little fish. Where they get entrained, and where they wind up, it just so happens that often, the places those spin-off eddy type currents, the places they take them, the reason there's an eddy there is that there's an island, there's a tributary coming in, there's something going on that sets up that condition where they might, just like in rafting, they kind of eddy out. It typically is a place where they can survive.

Bill Moser: What other interesting considerations do you have on your slide show?

Zack Bowen: We have one more interesting thing, I forgot, there's one that we didn't show. This is very interesting, to us [see PowerPoint Slide #69]. This is the top-secret fish habitat work that very few people know about, including us. It's so top secret that we don't fully understand its value yet. Remember when we were talking about the echosounder, when we were riding around collecting data with that, that's telling us the depths. It's actually a pretty fancy one, and what you're really recording is an echo off the bottom, but the form it takes that you look at on a computer is a curve. It's a voltage curve, and so the peak of that voltage curve is sort of where the bottom is, but you can dissect that curve into pieces and real smart engineers in Norway have figured out that if you look at different pieces of this curve, you can get some idea about characteristics associated with the bottom of the river. Now, to be completely honest, the bottom of the river here during runoff is moving. It's moving quite a bit. The point is, in theory, you can take these different pieces of the curve and look at them, and determine what is making up the bottom. Is it sand, or is it gravel, or is it boulders or what? Well, we messed around with this for awhile, and realized that well, gee, it looks like the bottom is moving so much if you look at this in a whole bunch of categories, it looks like camouflage almost, if you add a lot of colors here. And what we think is going on is that, in essence, you're looking at a moving bottom that's comprised of a bunch of different things bouncing along down on the bottom of the river. But, if you squint, and look at this, what we've done is we've overlaid a part of that voltage curve that's telling you about the relative roughness of the river bottom, and we've overlaid that with a photograph which was taken of course at a much lower discharge, so everything that's got some kind of color, that's where we went with the boat, and you can see there's a bar here, and it's got relatively low roughness, and most of the main channel's got higher values. It's almost a trend because you can see it here, and here, and here, quite a few places, and these bars are probably gravel or something like that, not very consolidated material, probably not really big, and it showed up.

Duncan Patten: That's subsurface, the barb?

Zack Bowen: Yes. When we measured this, everything that has color like all this here, was under water. That white showing through there is part of the photograph that was taken at a very low flow, and that's actually the forest that's really there, and that's kind of the point of this slide is just to show that, indeed, you can identify places where roughness is a little different. Now what this really means, we haven't used it a whole lot. We were thinking that we might be able to say "gee, it's the shallowest flow, and it's got really big rock substrate. But like Terry was saying, this is a very high energy river, stuff is moving, you couldn't really do that, or we couldn't really do that. And this, I promise, is really the last slide, that's it.

Brad Shepard: Did you ever try and simulate one whole side being riprapped, on one of your reaches, just for grins, and see what it might do to the other side? That's always been a huge question.

Zack Bowen: The places we got to that was what Terry spoke about earlier, with that detailed reach. That was sort of the opposite of what you said. We took a place that actually had a couple of barbs and then showed what happens if you take them away. It would be very possible to do what you said.

Brad Shepard: That's always been a huge question.

Terry Waddle: My hearing deficiency is a problem because you weren't using the microphone; so let me repeat what I think the question was. Did we simulate the conditions where there was riprap on one side of the river and show the effect that that existence, or lack of it, had on the other side of the river? First, the answer is no. Secondly, to do that, we would need another component, which would be actually a sediment transport component to this model and the requisite data for that. I'd love to do that study, it's about a $5 million study on this river. Where's your checkbook? I'm not being facetious. The problem is you have to actually collect the bed material as it's moving at a very high discharge like we were out on, and the difficulty of having a stationary platform and so on, just the infrastructure to get the proper data set would be a big capital investment.

Joel Tohtz: I just want to confirm that what you did was you went out and you took depths and flows, and what you didn't do was you didn't go out and catch fish and quantify juvenile abundances and that sort of thing. The reason I'm asking this question is because we have been hearing questions about juvenile recruitment, juvenile survivorship, do they starve to death. That's not what really you studied, am I right?

Zack Bowen: You're correct.

Joel Tohtz: And I have three things I want to say to our Colorado visitors. This river is different I think than what you've experienced in at least three important ways. One is that it isn't regulated, you recognized that. The headwaters are in a national park, which is similar to some rivers in Colorado of course. We have a large drainage that is still connected. In Colorado, my impression is that there's a valve at the lower end of every tributary and a lot of them along the way, a lot of regulatory fixtures that change the rivers as you mentioned. When you talk about recruitment, this is the place you might want to look at it because we do not stock our rivers. So, what we have is wild fish reproduction, and if you can look at how that works or doesn't work due to modifications or not, lack of shallow, slow habitats etc., this is kind of a nice place to do it.

Karl Biastoch: Would you recommend combining this study with actually going out and doing a fish population study on the study area at the same time, in the future?

Zack Bowen: I think that's a good suggestion. That, in essence, is what we did with Al with his focus, as everybody knows by now, was juveniles. But it would be real interesting to do the same type of analysis, if you remember those different colors we had, sort of the light blue that included places where adults might be. It would be really neat to look at adult distributions and compare, say, we can show you what it looked like at base flow based on measurement and simulation, and show you where the adult habitat is, and overlay some real adult fish data on top of that, and look at all kind of neat things. We didn't do that, but you're right, that would be an interesting thing to do.

Karl Biastoch: Yeah, it would be very interesting because your idea of the roughness, since you can add an idea of some type of roughness of the bottom, you may be able to figure out where some of these areas are in the river, that the little fish, and even the big fish, are inhabiting.

Zack Bowen: You're right and it's just kind of like what Terry was saying, it's a matter of time and money, and we've concentrated on what we thought was best to fit in with the juvenile study.

Karl Biastoch: Would you recommend that the Army Corps of Engineers consider doing this in the future, to look at this maybe downriver?

Zack Bowen: Most definitely, yes.

John Bailey: If everyone is comfortable, I'd like to move into the next section, the General Discussion, if that's okay. Thank you very much.

4. General Discussion Session

Dave Haug: We had some maps up there on velocity, depth, and direction. I think these things would be something, and probably are already being used by the engineers for proposing riprap and different modifications. I think for all future projects it would be good to have something like that, and I don't know how much of that has been done, or how much could be done, but it's just a comment. It also could show what could be done with soft techniques versus hard techniques. Some of the stuff with the high currents right along the edge are definitely not going to be using soft techniques.

John Bailey: Liz, this will be incorporated with the GIS and overlaid with everything else, correct?

Liz Galli-Noble: Yes.

John Bailey: Remember, we've done this for all the studies. The reason we use the GIS at all these points is to overlay all of them on top of each other, so you're probably going to have to hire somebody at the Conservation District to read these things. There's going to be an incredible amount of data.

Bob Wiltshire: One of the things that I see coming out of a lot of these is—and Zack talked about it in his concluding remarks—that we tend to modify the areas that have the high energy because that's where the river wants to cut. Those are the areas that will cut our new side channels and create the variability in the river bottom. Yet, those are the very areas that the landowners most need to protect, because they are the ones that are losing what the river is taking. If we need to allow the river to take, to maintain it's ecological health, how do we find willing landowners to say "take it from me?"

John Bailey: You'll have to answer that.

Andy Dana: Go to the other side of the river. One thing to think about, again I don't want to suggest that bank stabilization is a good thing necessarily, but if it has to be done to protect property rights, maybe there should be some exploration, by the Corps or others, or some hard looks given toward structures that can preserve shallow, slow water habitats. For example, on some of our side channels, we've preserved those side channels for many years during high water. They're ephemeral with rate control structures, which allows the water to spread. And they allow the river to use the high water channels from year to year, but they don't lead to runaway banks. Just a comment.

Jerry O'Hair: Well, I guess I'm kind of wondering, this soft approach to riprap or bank stabilization, I don't think this research really talked about the difference between soft approach and hard rock approach, and I'm not clear on what might be best for the juvenile fish.

John Bailey: You know what's becoming apparent to me is, we did a lot of study on the juveniles, which we hadn't had in the past. My sense on the soft technologies, when people were talking about it is that it is good for fishing, and it's good for the bigger fish, but we've never created that data, and it seems to be a hole.

Bob Wiltshire: Well, when Scott Bosse was asking about what we were talking about earlier, the fish data we based off the work of Dr. Zale, it seems to me like what we're looking at here is two different situations and we can't just say one size fits all, for the juvenile fish. What we're finding here tonight, is that they have one distinct set of needs at the highest water periods of time, and we have to ensure that they have those slow velocity waters at high flows. But as we drop down to those lower flows, at those periods of time, the fish are in those margin areas right along the riverbank and it seems to me that that's when we talk about fish friendly structures. What can the fish use best when they are in those habitats? Not when they are not there at all.

John Bailey: But Joel said earlier tonight that he thinks most of the recruitment comes in from the tributaries and the spring creeks. It seems to me on the juveniles that we have a huge hole; we certainly exposed some things that we've never looked at, but as far as I'm concerned, the hole is just as big as when we started. We don't really know how important the tributaries, the spring creeks, or whatever else are.

Joel Tohtz: The whole Integrated Project Design chart that Duncan holds up every meeting could just be fish apparently, because that seems to be where we always end up. I did not say that most of our recruitment comes from tributary systems or the spring creeks. If I did, I didn't intend to say that because I don't know that. But I do know a significant number of fish are produced in the tributaries and do come down and join the Yellowstone mainstem populations. I would not want to, in anyway, minimize the importance of the mainstem spawning, rearing, and recruitment features of the river and more importantly than that, I wouldn't want to minimize the importance of protecting and maintaining those over time, if we're going to hold onto what is a pretty tremendous fishery.

Jerry O'Hair: I'm wondering what the definition of a soft approach is? What is the definition of soft riprap and so-called hard riprap?

John Bailey: I thought you were the expert.

Jerry O'Hair: No, I can't figure it out.

Duncan Patten: I'll give you a big book on stream restoration that has all of this stuff in it.

Dave Haug: My personal take of what's soft versus hard is: hard is anything with solid rock covering almost every square inch of the bank, and soft is incorporating in willow plantings and woody debris, stumps, whatever else you can do besides solid rock.

Jerry O'Hair: Okay then, getting back to tonight's presentation, they kind of indicated that maybe that was more cosmetic than it is padding to the little fish. Isn't that what he indicated?

Duncan Patten: He was talking about the fact that soft bank stabilization really doesn't function any different than the hard bank stabilization under high flows. You've got high velocities there and it really doesn't make any difference. When you get down to low flows, perhaps if you have a lot of vegetative material mixed in with the rocks, maybe you have more little nooks and crannies. I want to go back to Joel's comment about juvenile fish. Certainly many may come out of the tributaries, but they do eventually work their way down, and they get washed out into the mainstem as well, and some of them find proper habitat in the tributaries. So if you're going to maintain a population, you have to have habitat in the mainstem as well as habitat in the tributaries. We did not go into the tributaries in our studies. That was a big discussion as to whether we went into the tributaries or not. Once you start up the tributaries, where do you stop? And so we left the tributaries alone, which in some ways I regret, but no, that's another major effort, and so be it.

Laurence Siroky: I guess what I heard is whether you use a soft approach or a hard approach, if you cut off the side channels, that has the impact on the juvenile fish. So what I heard is that it's the side channels that really make the difference.

Duncan Patten: Let me respond to that. It depends on what you're trying to stabilize. If you're just stabilizing a big, cut bank, you're probably not going to have a secondary channel form at that point. If you try to stabilize an area where overbank flow begins trying to cut a secondary channel, then you're eliminating a secondary channel. So it does vary as to where you're putting your bank stabilization.

Bob Wiltshire: Well, that just brings me back to the first thing I said. What landowner is going to allow that secondary channel to cut across their property, and that's one of the things we as a group have got to deal with here, is trying to put in place incentives or somehow struggle with this. I don't have an answer, but I think it's a pressing question.

Laurence Siroky: Bob, a partial answer to that is that if the area is designated as a 100-year flood plain, then those areas theoretically are off limits. There is an existing statute in the County regulations that doesn't allow those 100-year flood plains to be cut off.

Bob Wiltshire: From overflow?

Laurence Siroky: From overflow.

Bob Wiltshire: But you could stop a channel. You could armor that bank right up to the 100-year level, which would stop it from cutting a new channel.

Laurence Siroky: If it cuts off the 100-year flood plain, it's not allowed.

Bob Wiltshire: Right, you can't raise your flood level.

Brant Oswald: One of the things that occurred to me when we were talking about the tributaries supplying fish to the mainstem, in terms of the spring spawners, when does that occur? I know there must be a scientific term for it, "downmigration" of those fish when they leave the tributaries, do we know the timing of that? When does that happen?

Joel Tohtz: The third week of August.

Brant Oswald: I was just trying to put that in a timeframe with when runoff is occurring was the point of the question. So it would be the following young of the year that would be the juveniles that would be leaving?

Joel Tohtz: The young-of-the-year outmigrants will swim downstream in late summer or early fall, however you look at that. That's spring spawning fish: cutthroats and rainbows. Rainbows tend to come out a little bit earlier but they overlap in this, and they do tend to be a little larger of course because they were hatched earlier.

Brant Oswald: One other comment that I have. I think one thing that we will need to find out before we're through with this whole process, and we've talked about a little bit tonight, and I think all the landowners have been concerned about it, is hard rock techniques versus the softer techniques. I think the one comment that one of the researchers mentioned tonight was that, if you take riprap and pour dirt on it and plant some willows, in high water that's all going to wash away. One of the questions I asked early on in terms of whether things like roughness coefficients were standardized, I think one of the questions that we need to come back to is to get some idea of whether there are different types of technologies that can be used that actually work better in terms of those roughness coefficients. I've heard from landowners that riprap is the only thing that slows the water down, and I've heard other people say that riprap actually increases velocities and it seems like that is one of the questions that we need to come back to if we are really going to consider different technologies. Whether we talk about riprap, there's riprap with really big rocks, there's riprap with smaller rocks, and so on. I think those are some of the questions that we're going to need to talk about if we're really going to try to make recommendations on one type of technique over another.

John Bailey: But Brant, our recommendation may have to consider whether we are talking high flows or lower flows, and it seems to me that these structures are having a very different effect at those two levels.

Duncan Patten: All of the above.

Brant Oswald: I would agree with that and I think that those of us that fish the river would find that there are times that fish do use riprap and there are a lot of times of the year when riprap becomes a desert. That idea you have of high flows versus low flows is an important factor.

Duncan Patten: Brant, let me try to respond to one comment about riprap speeding up flows. One of the concerns I think people have is that as you stabilize a bank, and elevate the bank itself, and prevent overbank flow or cause overbank flow to occur at a higher flow, you tend to increase the velocity or you prevent the river from widening, and therefore you tend to increase the velocity and you get some downcutting. Maybe more with dikes and things that tend to disconnect the river from the flood plain, but that's one of the things. If you disconnect that, then you keep all the water in the river, even at very high flows. So that's one of the problems. If riprap allows normal overbank flow, then it's a different story.

John Bailey: We'll take comments also from the public now.

Andy Dana: To respond to Bob's concern about how do you get landowners to let the river take their land away, and the problem that we're facing is that the issues landowners face are very site specific. The problems are very site specific, so you can't really create a bank of willing landowners who are willing to say "okay, take my land, but just compensate me for it". I think that may be a dead end, looking at the problems in that way. Just my instinct. I sat that in terms of us making recommendations, because the issue is that landowners are always going to face site specific problems, and for us to make global recommendations about some landowner being willing to, or compelled to, or volunteering to, allow his land to be taken is a non-starter.

Bob Wiltshire: The thing I wonder though, Andy, is rather than site-specific recommendations, if we can make global recommendations. That we recommend the institution and aggressive pursuit of floodplain easements, or floodway easements, or whatever we want to call them. So that a willing landowner could find a willing party to compensate them to allow it to flood, should it happen.

Andy Dana: I understand that's the concept. But I think you're really going to run into the problem that a landowner is going to be faced with a critical decision about whether to save his land, and he's not going to be willing to turn to a conservation easement bank on somebody else's property. If that's what you're proposing?

Bob Wiltshire: No, I'm not.

Andy Dana: Essentially you are. You're saying we'll pay you if you let the river take your land. I think you're going to have a real problem coordinating that type of a mitigation type thing, with site-specific issues on individual properties. It may be possible, but I think that if you try to put it together, it's going to be a dead end. But we can look at it.

Zack Bowen: I think Mr. Dana has a good observation there, but at the same time I think you can combine the ideas that you guys are talking about and maybe as sort of a short-term solution that might be affected by a permitting process, looking at individual structures and these site specific questions. But as a long-term strategy, it could be, like Mr. Wiltshire talked about, the ultimate goal being as the land changes hands, and over generations, that things start getting broken up or wanting to be sold, things like this, then eventually, you might start doing some of that, buying easements or whatever, to allow setback levees so you can let the river work within a certain area. So I think you can kind of do both.

Jerry O'Hair: Well, I'd like to just follow up on Andy's scenario there a little bit. Being site specific, I think that in looking at the spring creeks, it wasn't the land particularly that we were trying to save, it was the natural resource, and that was the spring creeks themselves. The value of the land has been taken, the value has been depleted due to regulatory penmanship, whatever you want to say, in the fact that it's only of agricultural value because of regulatory laws. In my specific instance, I was not protecting land, I was protecting a natural resource, and that was the spring creek. And I think that if you would talk to Andy, that's probably his case also. Those are very unique areas and we weren't just protecting the land, we were protecting a natural resource. I think if the studies had gone far enough, you would see that their value in fish habitat would be invaluable. I really feel strongly that those spring creeks need to be preserved because they are unique, they're different than most any place in the world.

Karl Biastoch: This is a question that's going to have to be studied in the future. I think this board will not be able to come to consensus on side channels and spring creeks because you don't have the information right now to say one way or the other. And it looks to me like the side channels, if they cut into the spring creeks, the spring creek perpetuates the side channel as a way for smaller fish to live. It just continues the cycle, and so you're going to have to do more studies in the future to figure out what's going on. Whether you want to control whether people block the side channels, that even if they do cut into the spring creeks.

John Bailey: The Task Force isn't going to do any more studies. In case someone thinks that we're self-perpetuating, we go away. We may want to make recommendations that someone else do some studies into the future, but I do want to make sure to anyone sitting here, that we aren't going to be doing any more studies that I'm aware of. And we're going to run out of money anyway, so we have to go out of business.

Bruce Rich: I'll just make one little comment, just because I feel like it needed to be said. I don't know if we're going to get more information out of maybe Chuck Dalby or something that may get us to where I am heading here with this comment or not, but I caution everybody, I'm hearing a lot of focus on what size of fish use what kind of bank treatment, or lack of treatment, at what water level. And I hope that we're going to try to address: what do these manipulations, or lack thereof, do to the river and to the health of the river and the flood plain? And not just address so much of that micro-detail of these things that are going on out there.

John Bailey: Right now we have 22 pages of comments from all these meetings, and there'll be another five or so after tonight. We're going to then go through and try to sort out what our recommendations are. Each one of these only looks at one study, when we get done we have to try to bring them all together and we'll probably have to meet every night in order to get done. But I do appreciate your comments. If there are no more comments, I'd like to move on. I want to thank everyone.

VI. Other Business

John Bailey: Liz and I went to Helena. I wanted you to know that the DNRC is working exclusively for the Upper Yellowstone River right now. We have been assured that they will make a presentation to the Task Force in April, and Chuck Dalby will be here. He will not be 100 percent done, but he'll be 95 percent done on April 29th. And just to make sure, Liz and I are going back in mid-March. So, if you run into people complaining that DNRC is not doing anything, it's because they're working exclusively for us.

Tuesday, March 25th, 2003, Historic Watershed Land Use Study
Location: Yellowstone Inn

Tuesday, April 8th, 2003, Recommendation Process Meeting
Location: City/County Courthouse

Tuesday, April 29th, 2003, Geomorphology Study
Location: Yellowstone Inn

V. The meeting was adjourned at 9:50 p.m.